

IPM & Soil: Limiting insecticide use builds benefits



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IPM is the paradigm for pest control

IPM focuses on pests that are economically concerning

Much of current insecticide use is insurance-based (e.g., corn)

Neonicotinoid use is rarely risk-based; it is preventative and forced

Neonics disrupt many ecological functions, can exacerbate pests

No-till/CC provides a base for conservation farming and IPM

Progressive farmers will embrace IPM if they see the benefits

Integrated Pest Management

Uses a combo of biological, cultural, chemical tactics to control pest populations

Introduced in 1959 by entomologists to:

Protect natural-enemy populations = allies

Ensure profitability:

Only use insecticides when you know it will pay

Key principles:

1. Avoid preventative insecticides; insecticides are last resort
2. Scout to know what pests are your fields
3. Treat pest population if it exceeds economic threshold (ET)

ET \approx pest density or damage that will lead to yield loss

Field-crop production tends to avoid IPM, uses preventative strategy



Erin Gallagher

Insecticides (foliar, soil, seed coating) are useful

But they are overused, always have been

Insecticide use has increased since introduced following WWII

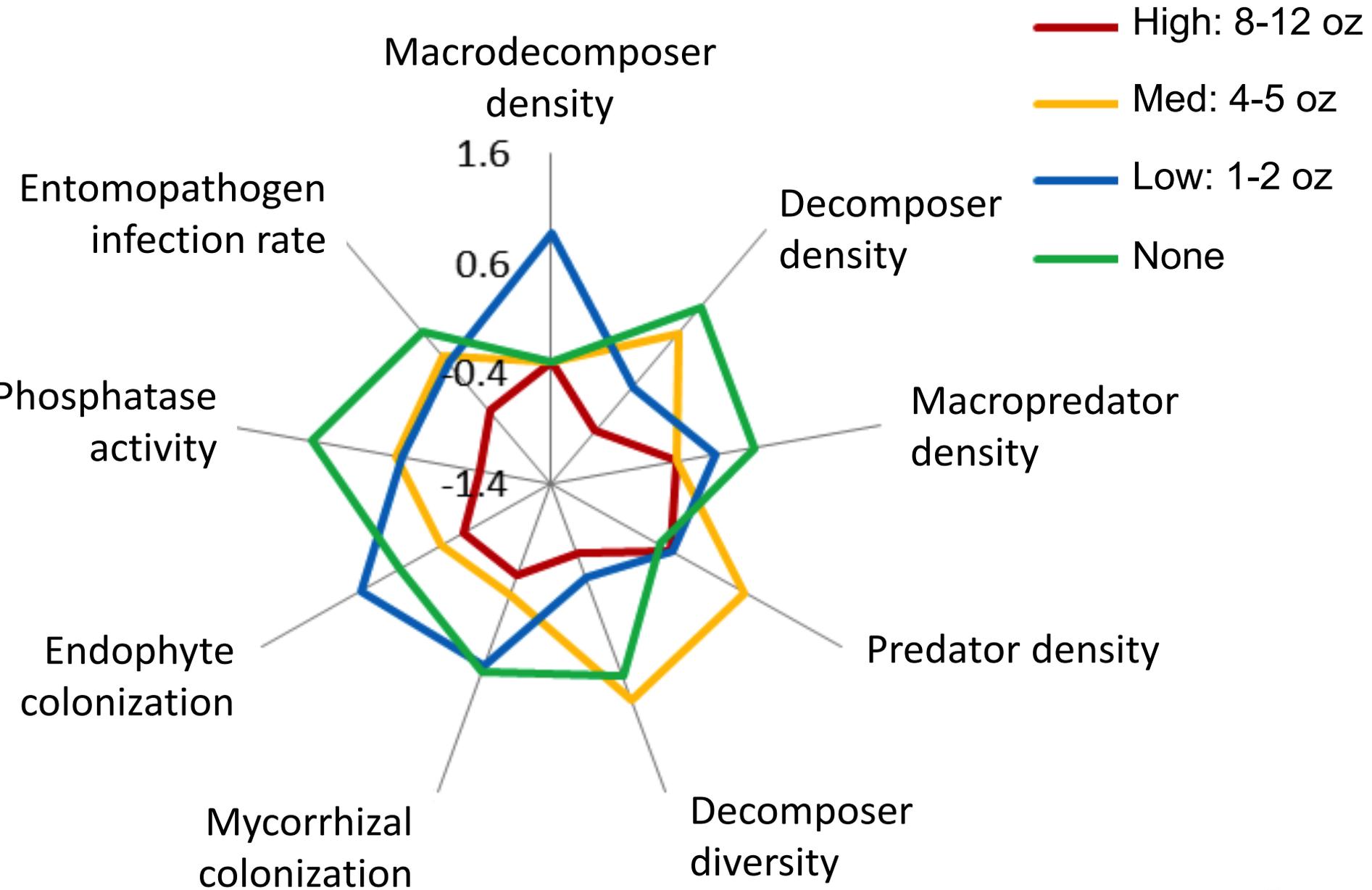
Most use is not used via IPM

Rather, they are insurance treatments:

Decrease good insects, make pest problems worse,
environmental concerns



Soil function is highest with no insecticides (Turf)



Benefits of neonicotinoid seed treatments

Water soluble, can be absorbed by plants

Can protect yield

Targeted application

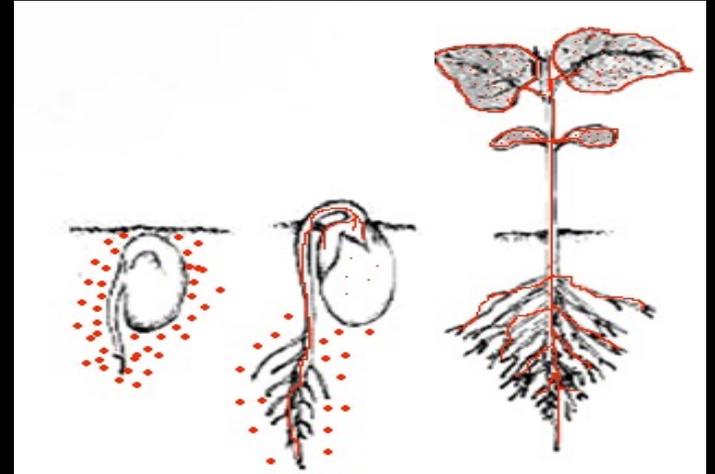
Low dose

Low mammalian toxicity

Low toxicity to spiders, mites

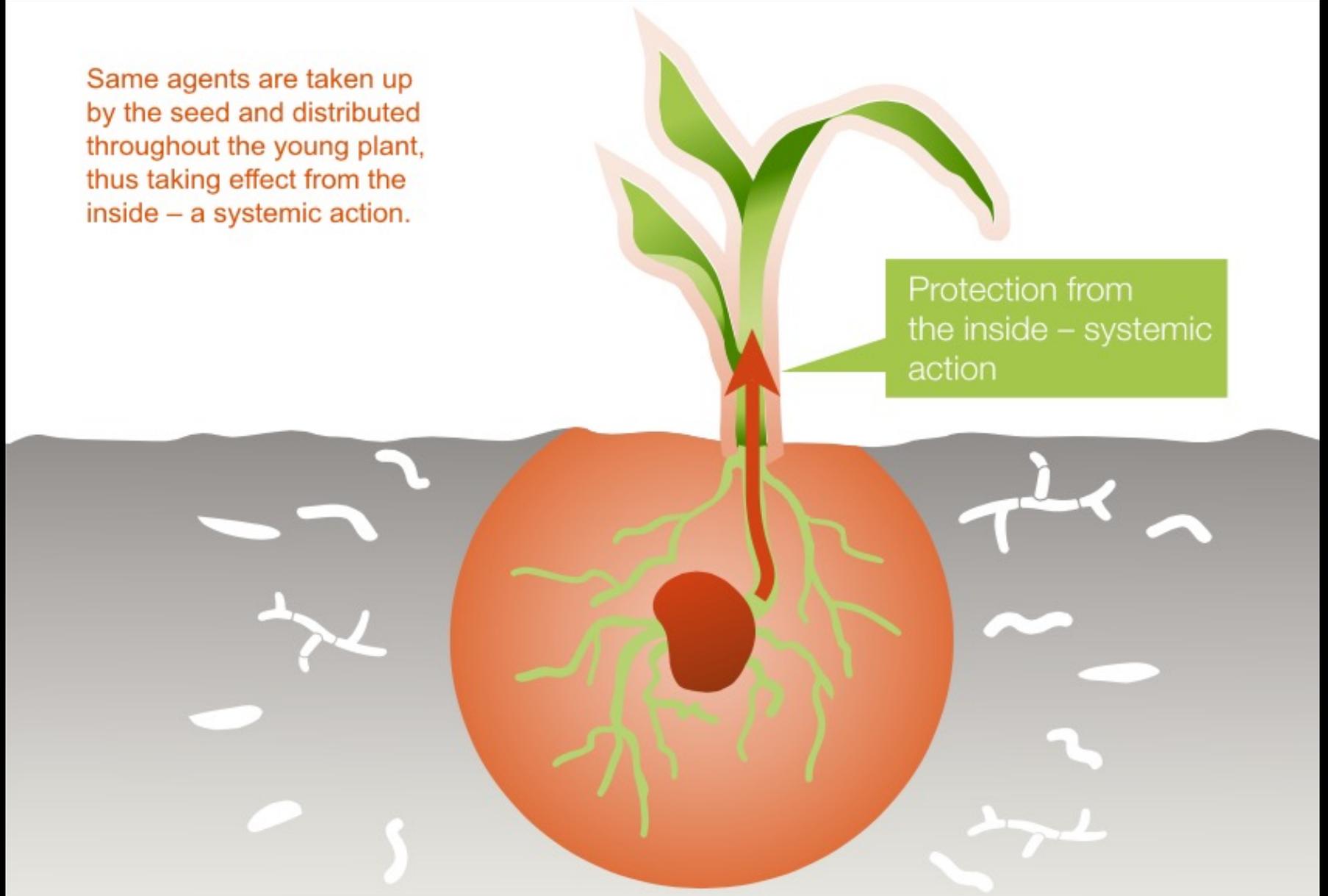
Systemic activity for 2-3 weeks

Protects plants when they are young and vulnerable



Benefits of neonicotinoid seed treatments

Same agents are taken up by the seed and distributed throughout the young plant, thus taking effect from the inside – a systemic action.



Limitations of neonicotinoid seed treatments (page 1)

Only protect plants for 2-3 weeks

Only 1-5% of active ingredients enter plants

Yield benefits are inconsistent

Only 5-8% of fields have yield benefits

Water-soluble; sufficient rain can wash them away

- Pollute ground water
- Persist in soil (7–7000 days)

Limit populations of beneficial insects

Allowing some pest populations to outbreak

Limitations of neonicotinoid seed treatments (page 2)

Highly toxic to insects

Among most toxic insecticides ever developed

They are toxic to other groups of animals

Toxic to some mammals via unexpected pathways

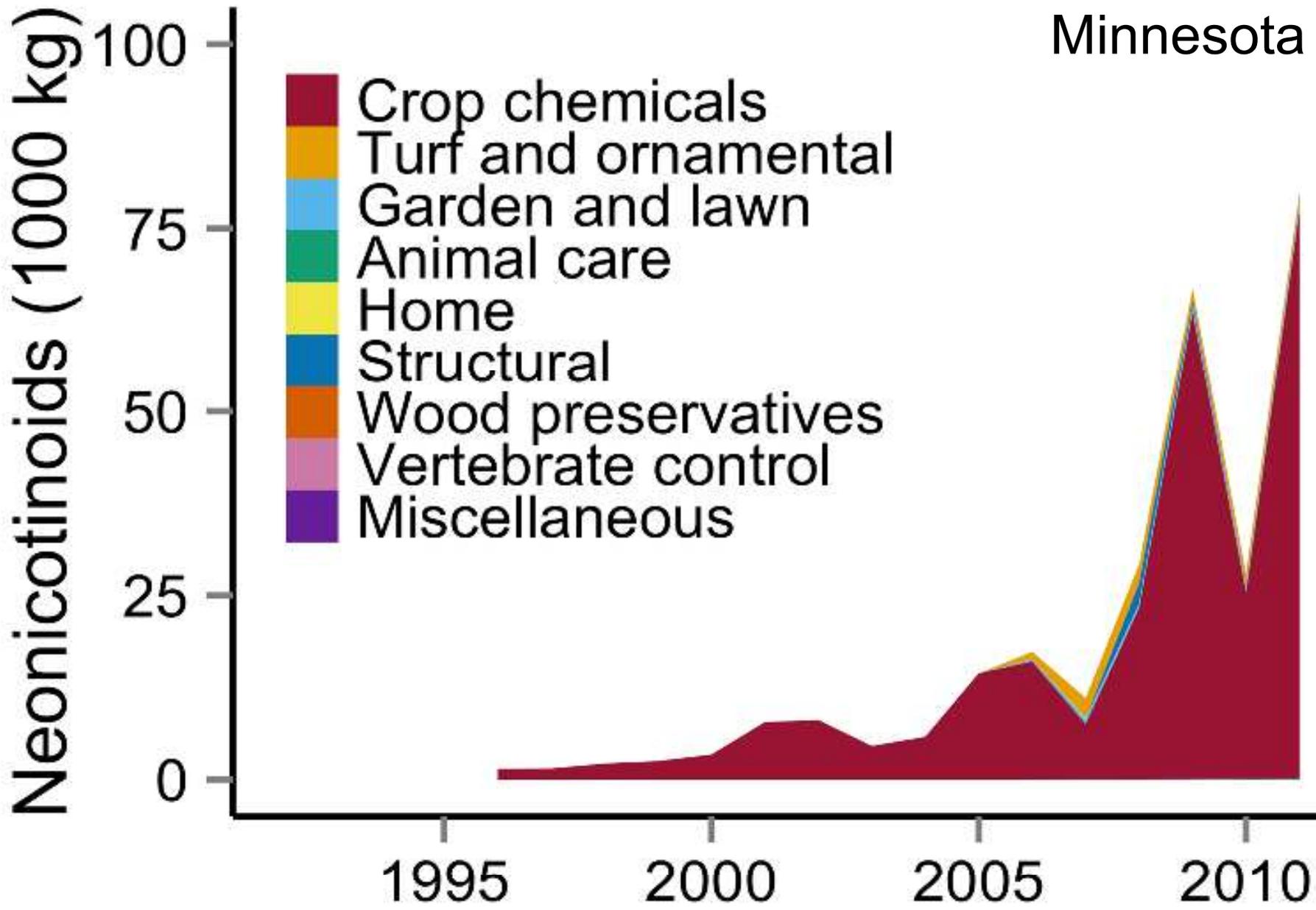
High toxicity to some bird and fish species

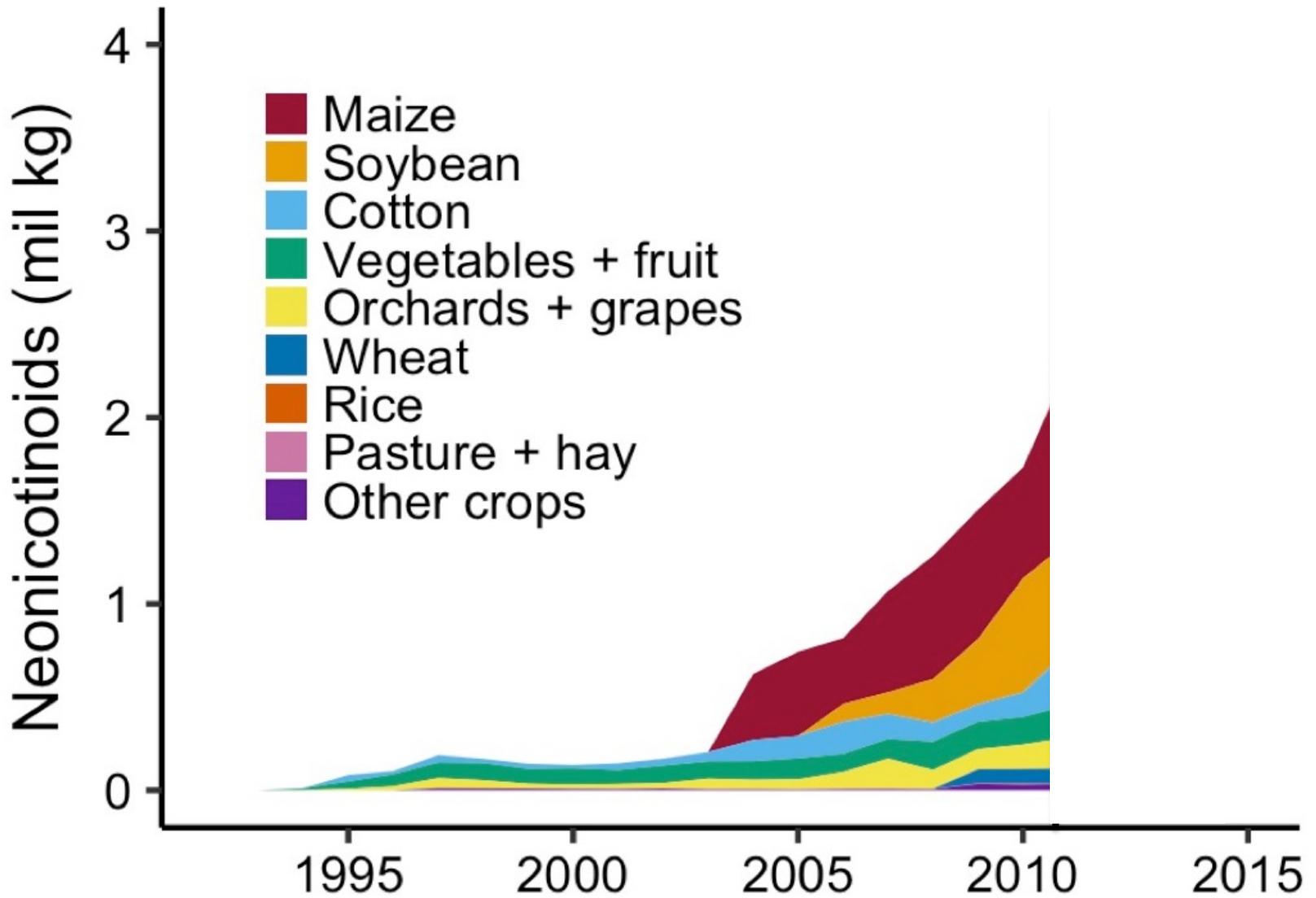
Reasons for variability are unclear

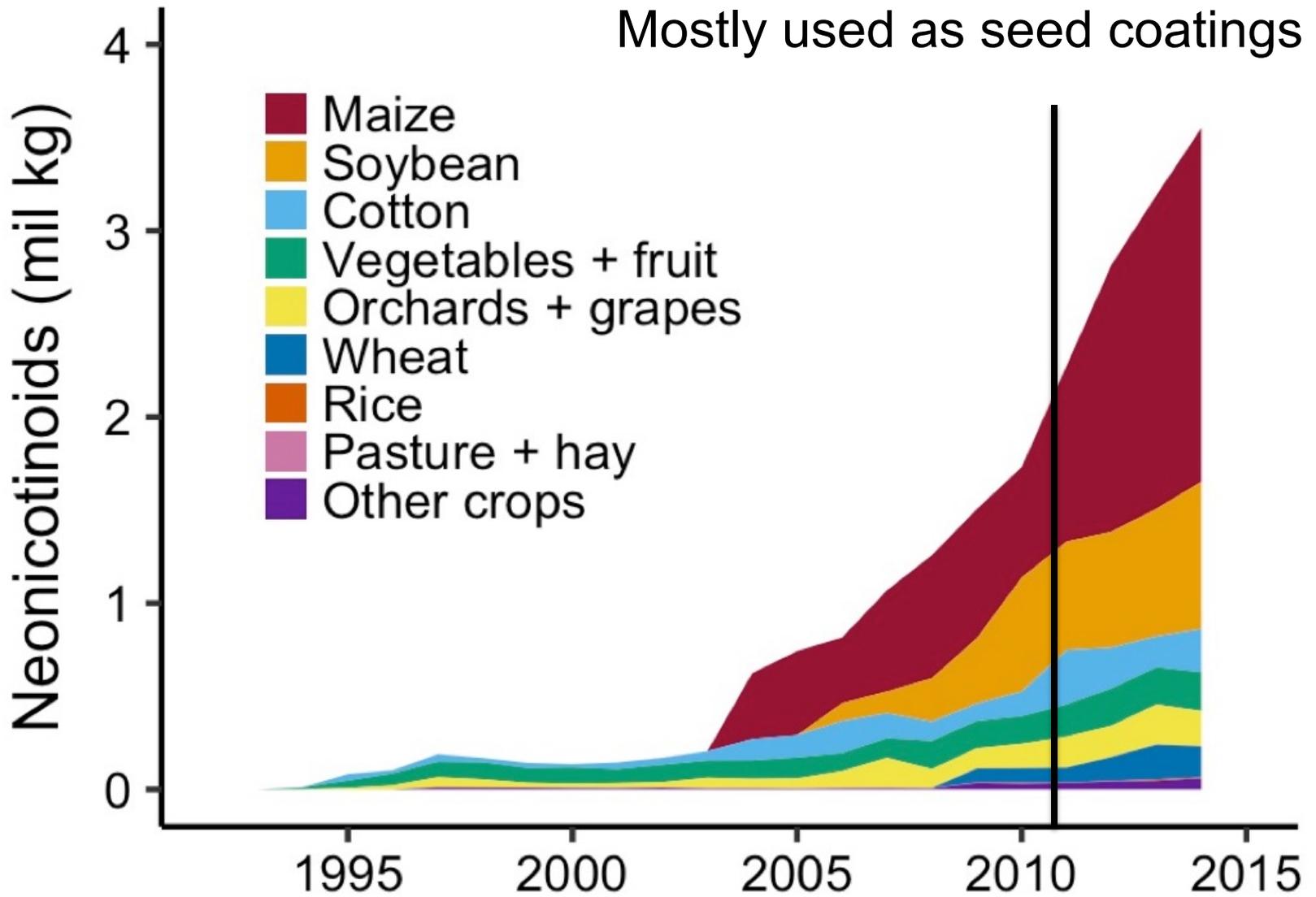
Their use as seed coatings is not being tracked by:

Federal government (EPA, USDA)

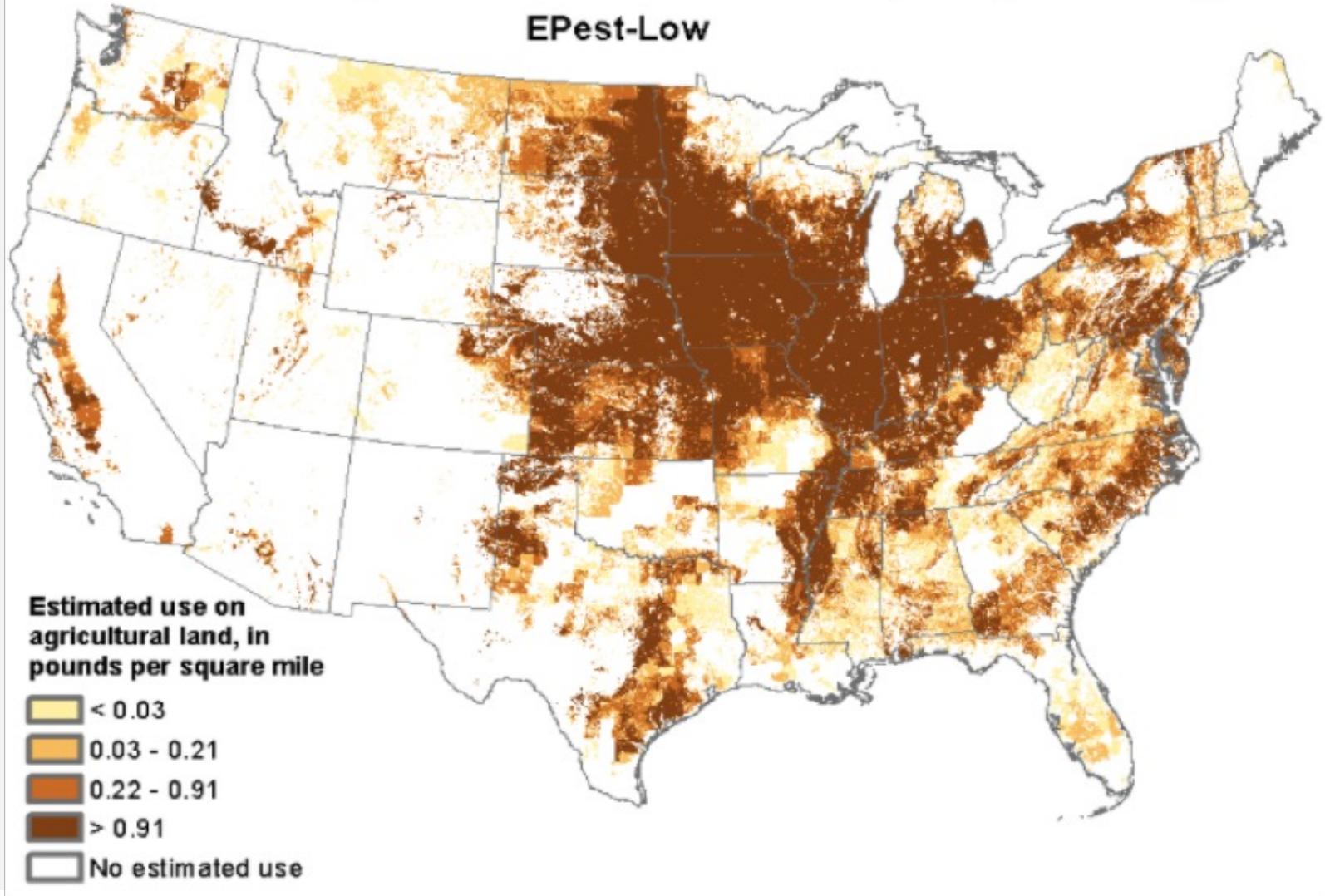
Most state governments





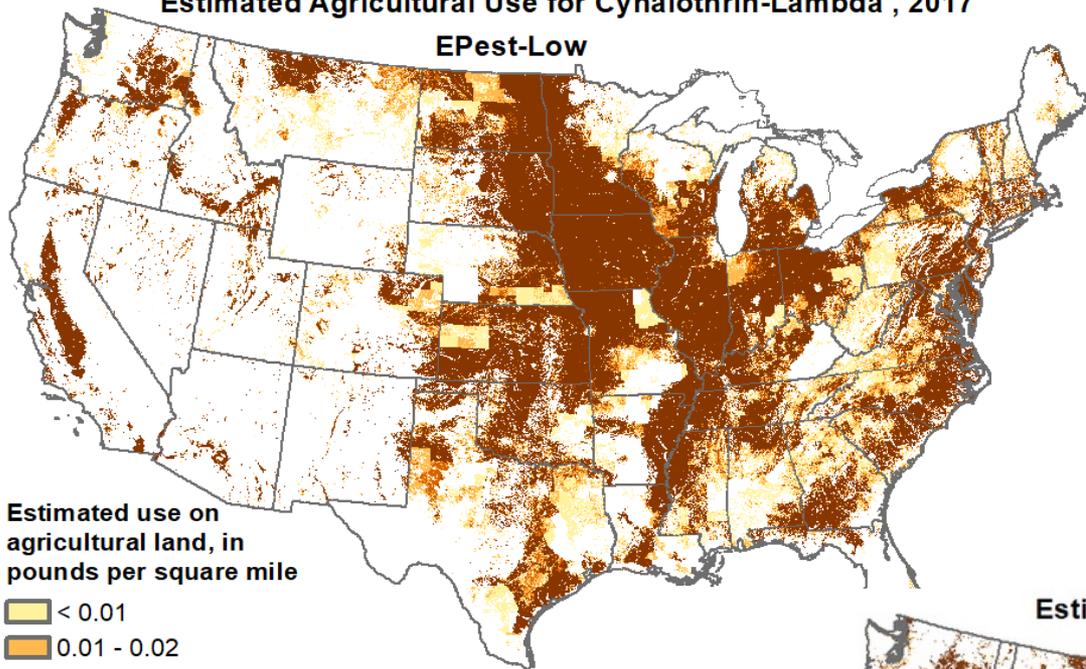


Estimated Agricultural Use for Clothianidin , 2014 (Preliminary) EPest-Low



Estimated Agricultural Use for Cyhalothrin-Lambda , 2017

EPest-Low



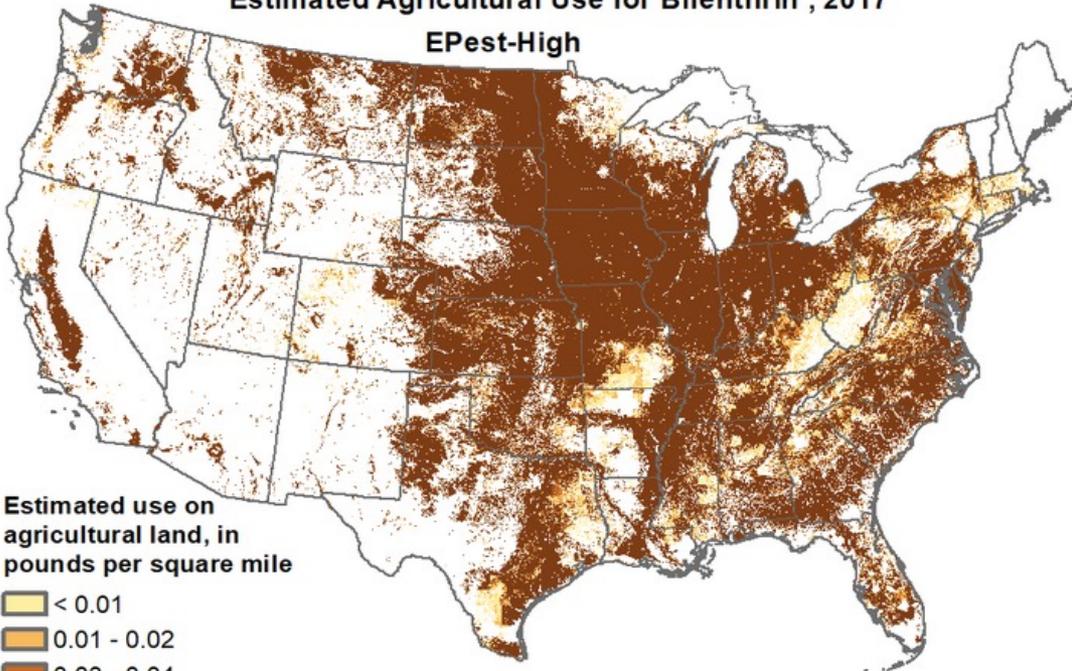
Estimated use on agricultural land, in pounds per square mile



An aside:
Use of other insecticides
is increasing

Estimated Agricultural Use for Bifenthrin , 2017

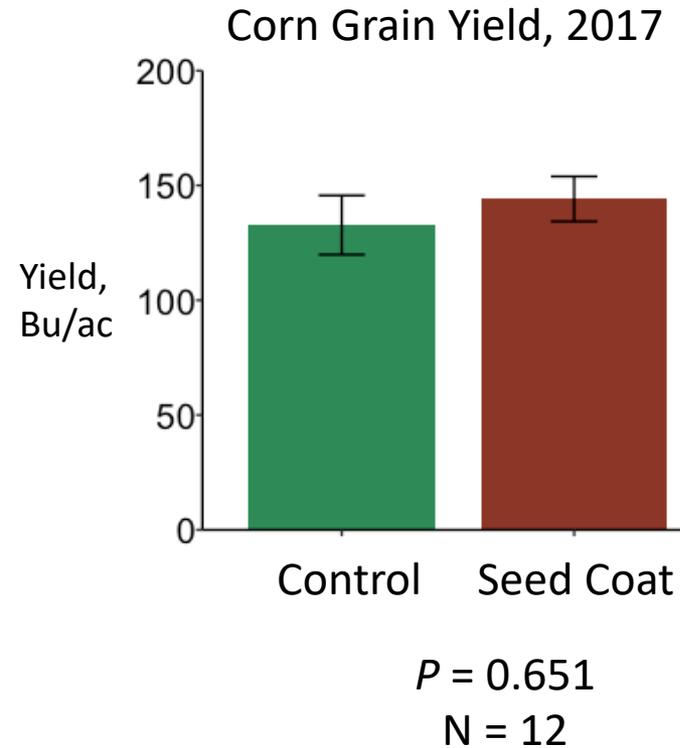
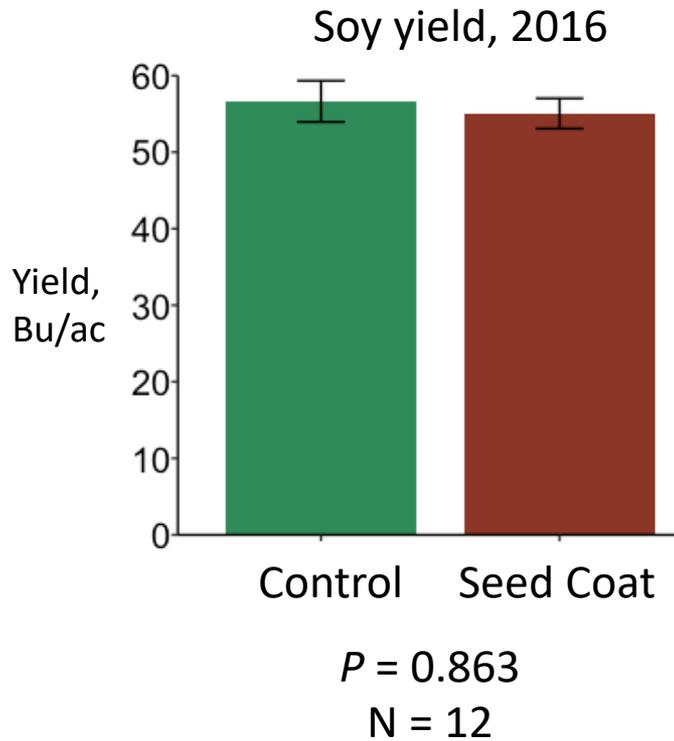
EPest-High



Estimated use on agricultural land, in pounds per square mile



No yield benefit from neonic use



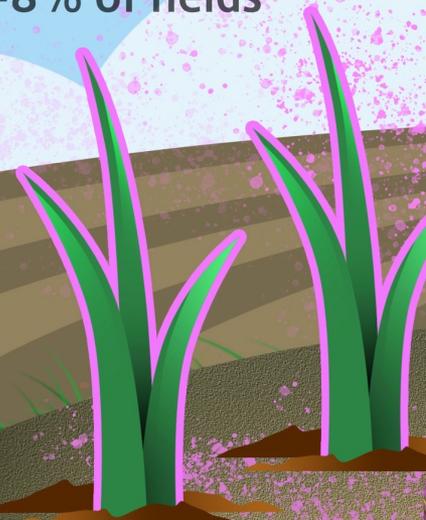
2-3%
Lost as dust
at planting



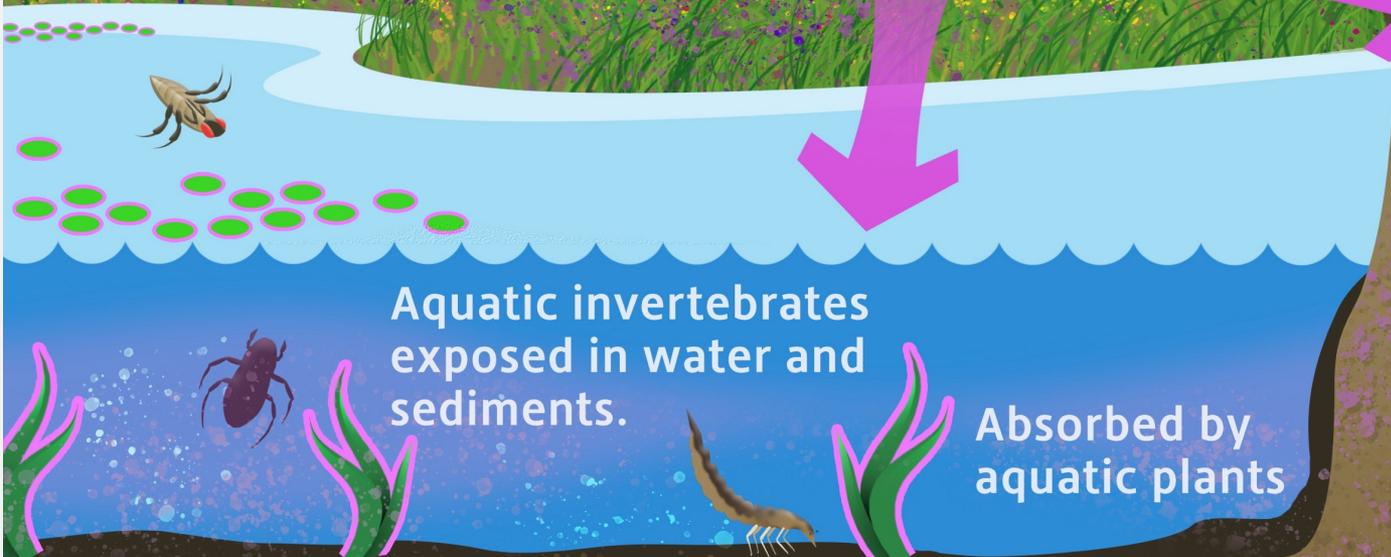
**0.25 - 1.25 MG
CLOTHIANIDIN/SEED**



2-3% Taken up by
plants, \$ benefits in
<5-8% of fields



90%+
Into water/soil,
non-crop plants,
\$ cost



Aquatic invertebrates
exposed in water and
sediments.

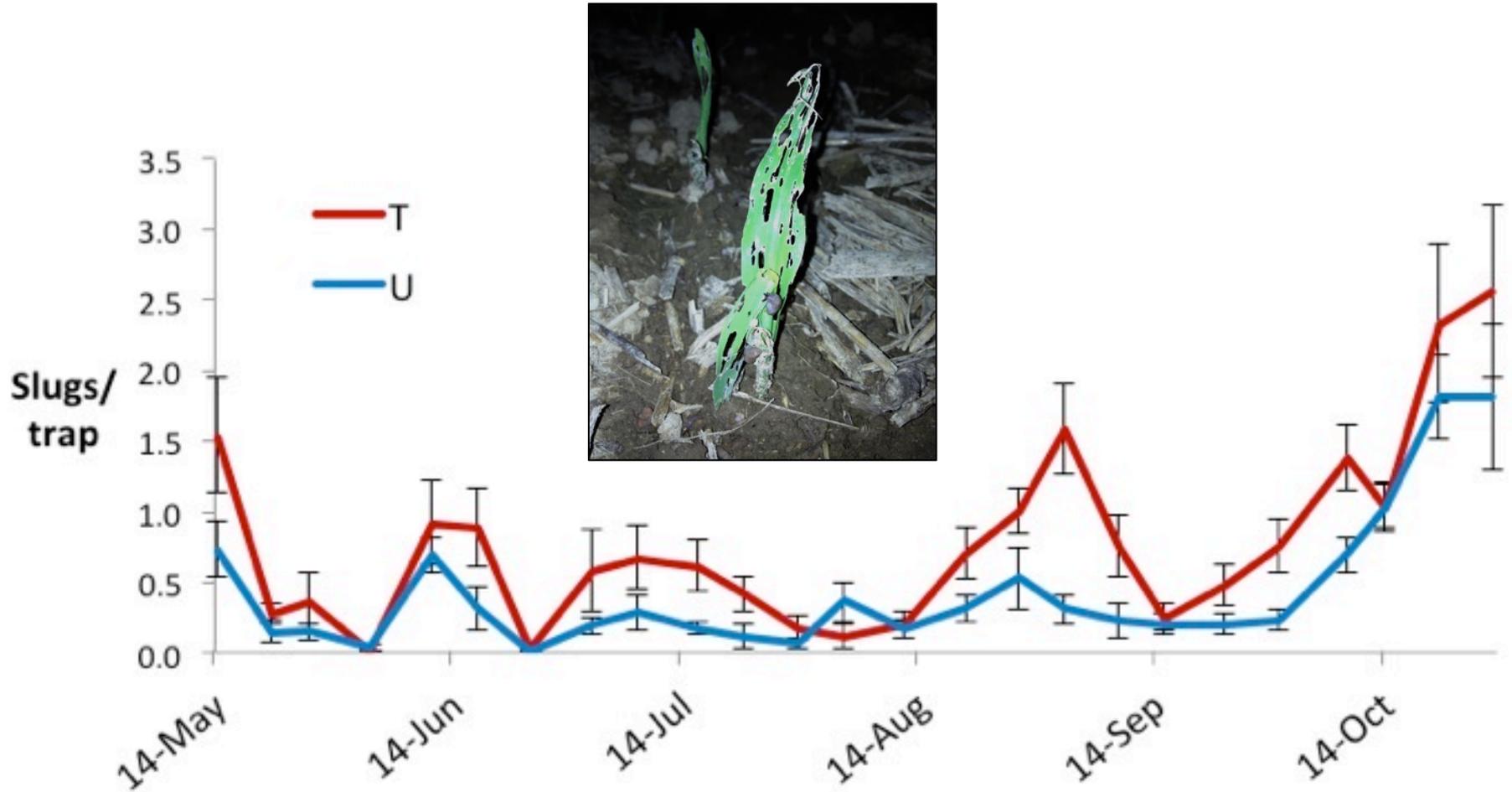
Absorbed by
aquatic plants

Protection from
root-feeding pests
for max. of 3 wk

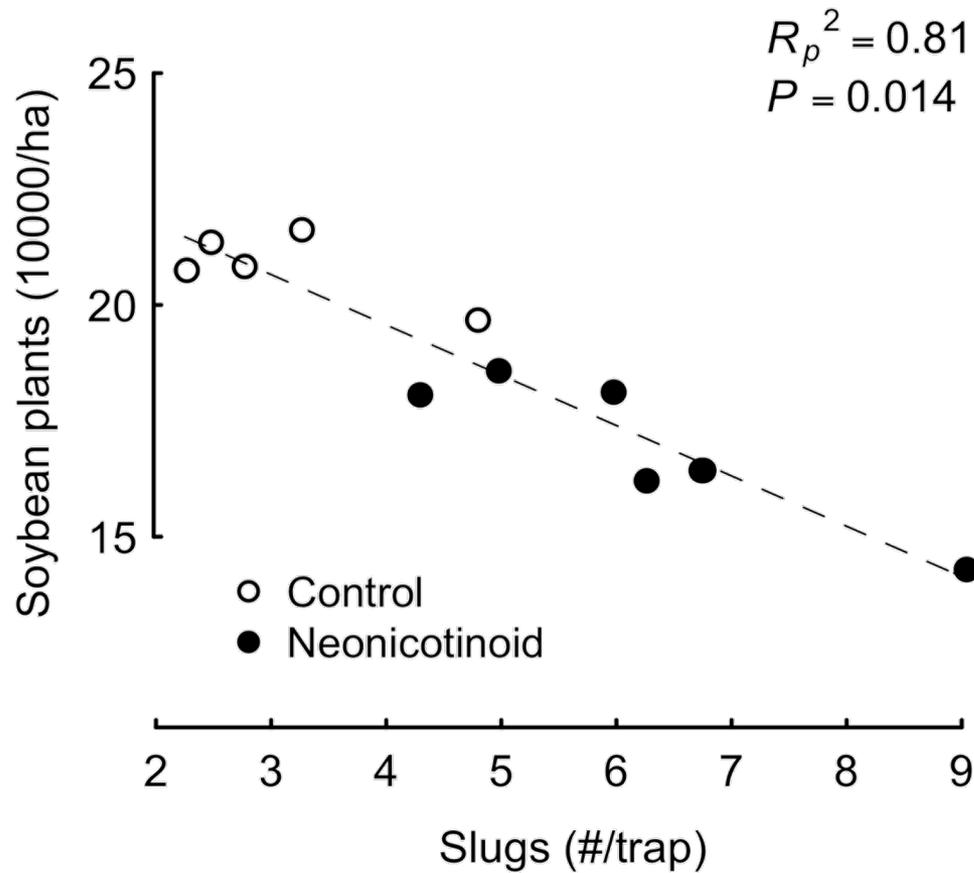


Neonic seed treatments exacerbate slug problems

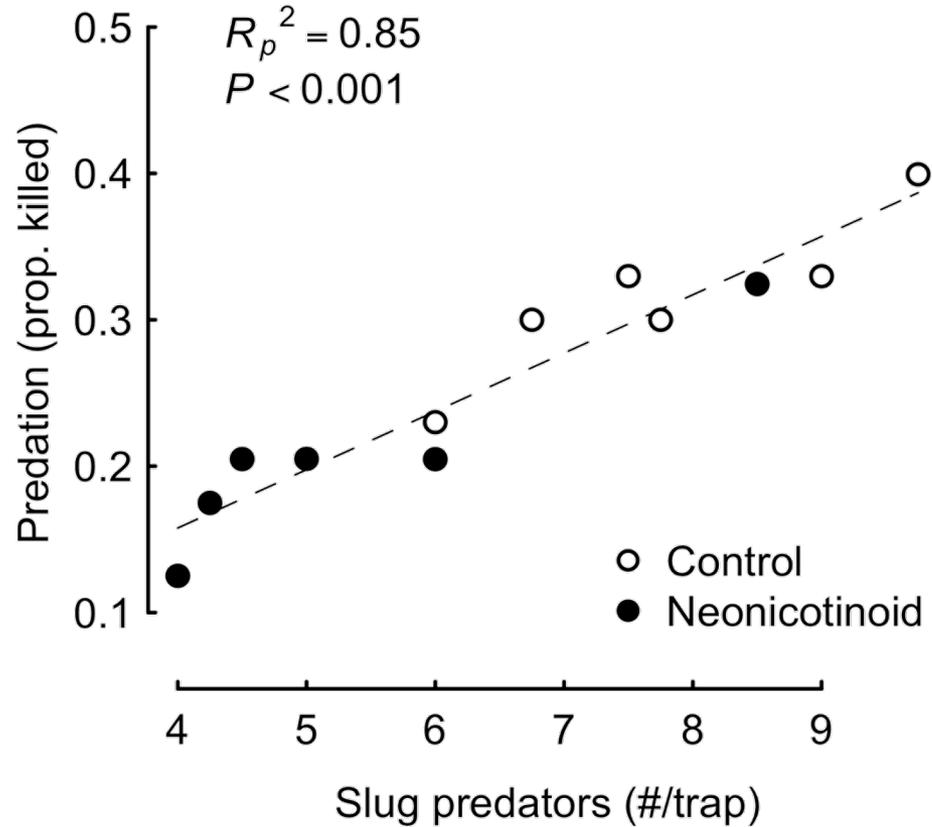
By killing predators, slugs decrease stand success and yield



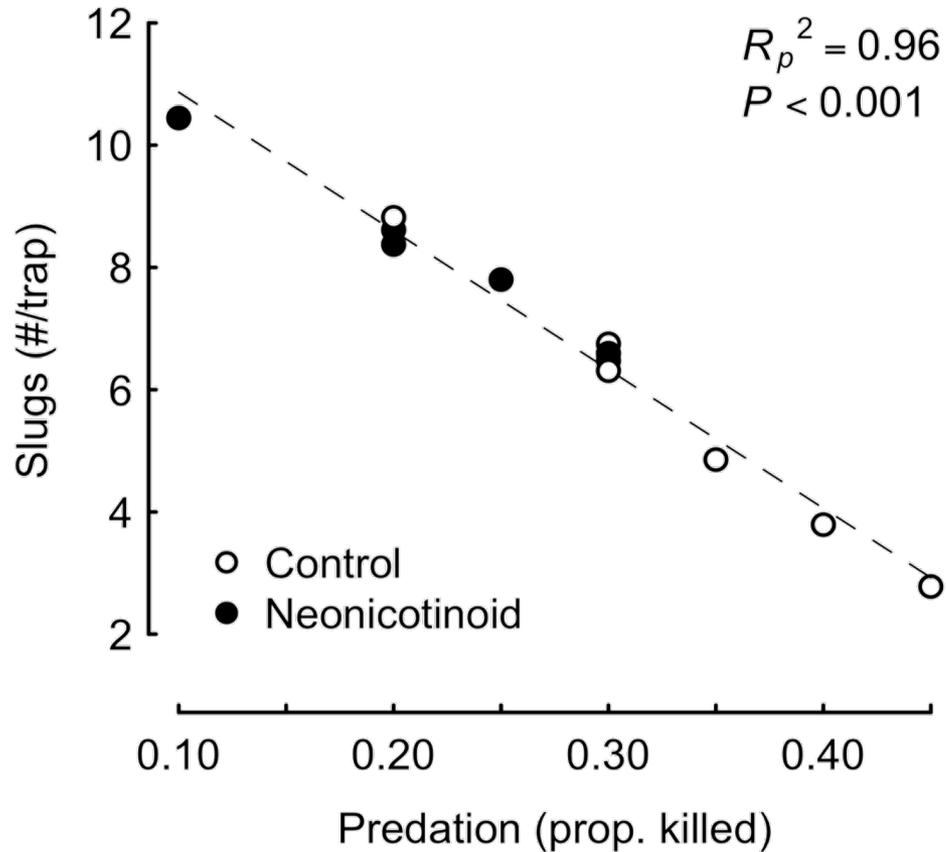
More slugs → fewer soybean plants



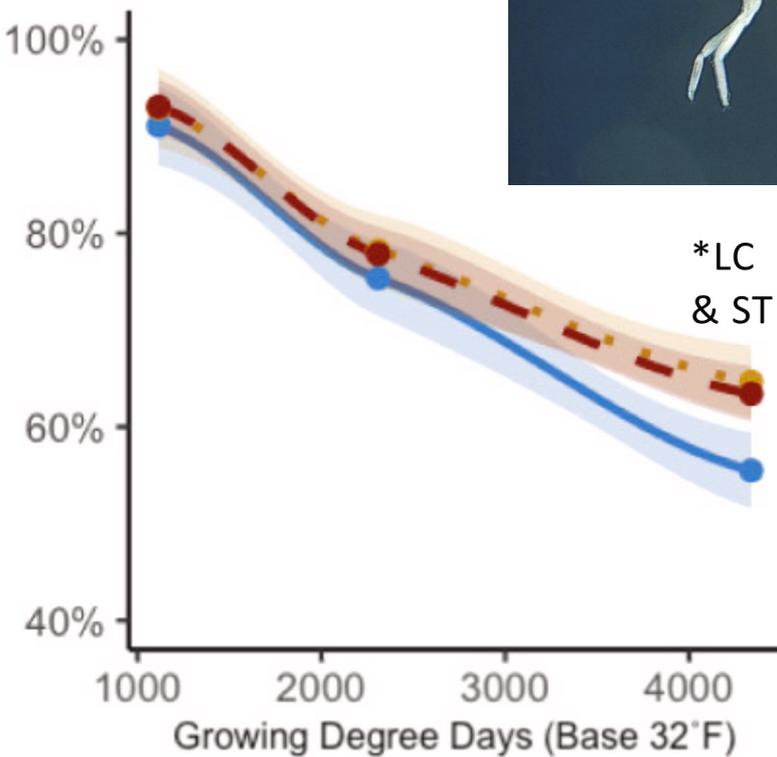
More slug predators → more predation



More predator activity → fewer slugs



Do insecticides limit decomposition? (three-year experiment)

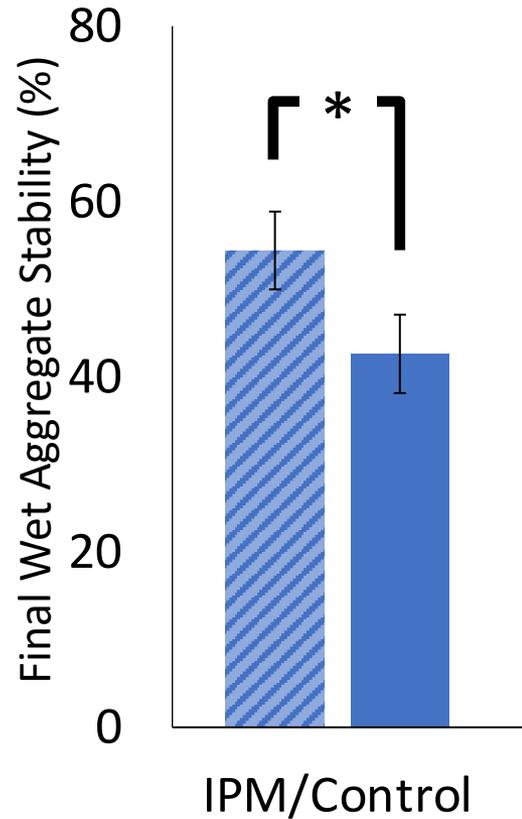


10% slower with neonics or pyrethroid
Fewer decomposers
Slower decomposition

Seed treatments decrease soil aggregate stability, ~3 yr



omafra.gov.on.ca



Cover crop



Seed treatments decrease soil aggregate stability, ~3 yr



omafra.gov.on.ca

Unpublished data remove



Cover crop



Bottom line:

Manage for the pests you have and your farming goals

Preventative insecticides, particularly neonics, can:

Make pest populations worse

Disrupt natural functioning:

Pest control

Decomposition

Soil aggregation

Others?

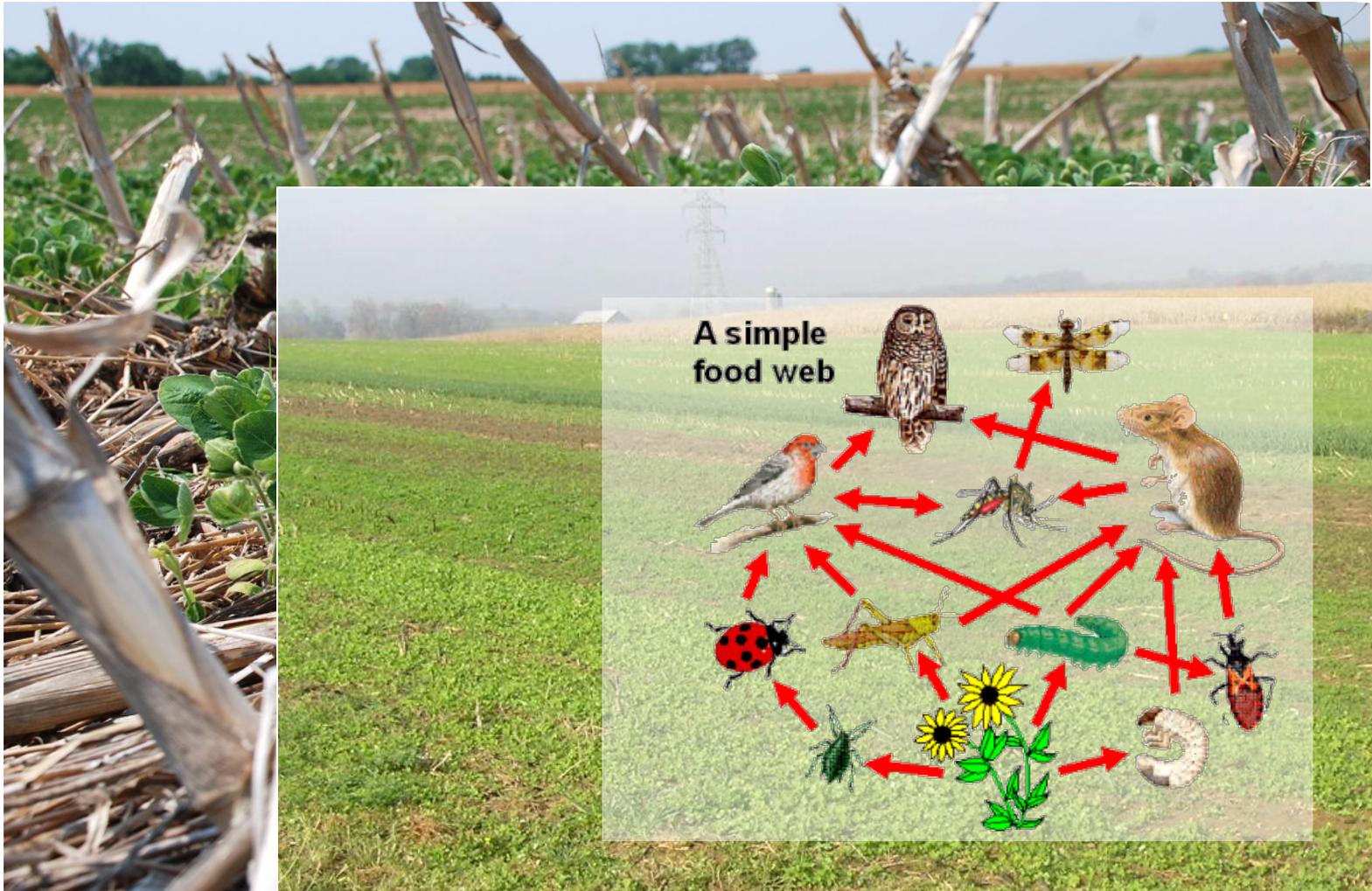
No-till makes conservation possible; & fewer pests



No-till makes conservation possible; & fewer pests

Stability provides habitat for beneficial organisms

Cover crops enhance good populations further



Penn State Diversified Dairy Cropping Systems project

One two-year corn-soy rotation

Bt, seed treatments, broadcast pyrethroid

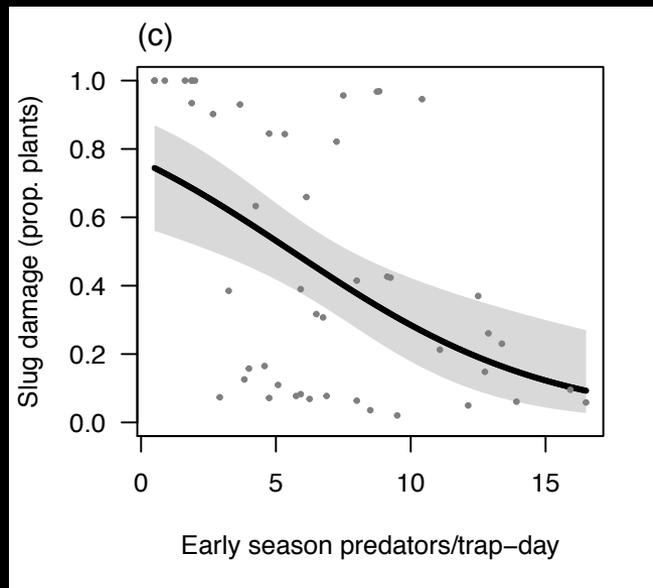
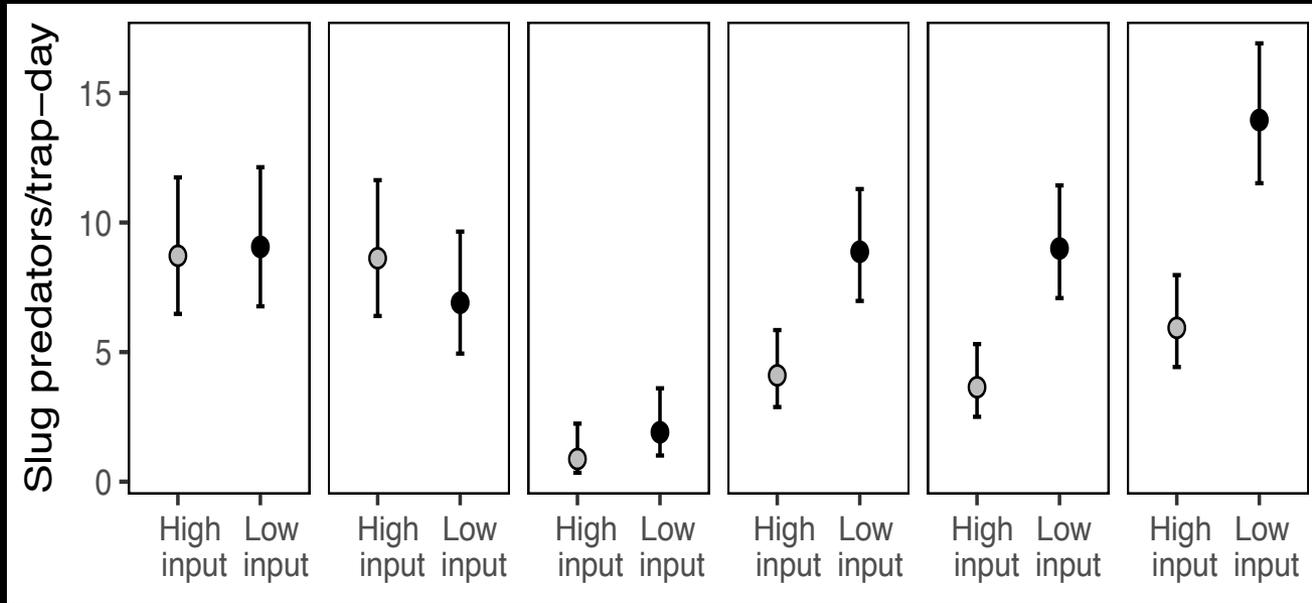
Pests have
been worse

Two six-year rotations (cover crops, alfalfa, corn, small grains)

IPM (no Bt or seed treatments, insecticides as necessary)



No-till, diversity (crop rotation + cover crops) builds predator pops



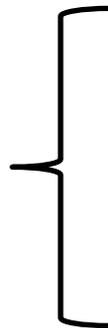


Farmers Improving Soil Health



IPM to decrease inputs & help protect NEs, soil health

Soil health



No-Till

Diverse rotations w/cover crops

IPM



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Thanks for listening
Questions?